

IRRIGATION FOR THE PIMA INDIANS.

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L E T T E R

FROM

THE SECRETARY OF THE INTERIOR,

TRANSMITTING

COPY OF THAT PART OF THE REPORT OF INDIAN INSPECTOR  
WALTER H. GRAVES RELATING TO IRRIGATION FOR THE  
PIMA INDIANS.

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JANUARY 14, 1901.—Ordered to be printed.

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DEPARTMENT OF THE INTERIOR,  
*Washington, January 11, 1901.*

SIR: In compliance with your request of the 10th instant, I hand you herewith a copy of that part of the report of Indian Inspector Walter H. Graves of September 12, 1900, which relates to irrigation for the Pima Indians, which was referred to in my letter of December 3, 1900, on the same subject.

Very respectfully,

E. A. HITCHCOCK,  
*Secretary.*

Hon. O. H. PLATT,  
*United States Senate.*

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DEPARTMENT OF THE INTERIOR,  
UNITED STATES INDIAN SERVICE,  
*Pima Indian Reservation, Ariz., September 12, 1900.*

SIR: In reference to your instructions of July 16, 1900, directing me to proceed to the Pima Indian Reservation in Arizona to "ascertain the feasibility of a limited system of irrigation by the construction of necessary ditches to take the water for the use of the Pima Indians from the reservoir proposed by the Geological Survey," on the San Carlos Reservation or elsewhere along the Gila River, "in the event that Congress shall hereafter provide for its construction, \* \* \* and prepare plans and specifications, with estimates of cost, of such ditches as may be necessary for limited irrigation and can be built for

an expenditure not exceeding the sum stated" (\$30,000), I have the honor to submit the following statement, for it has been impossible for me, with the means at my command, to prepare such a report as is evidently contemplated by your letter of instructions.

To prepare plans, specifications, and estimates of cost that would be in any way reliable and accurate for any system of ditches that would be extensive enough to cost \$30,000, it would be necessary to make a very careful reconnoissance and an instrumental survey, and to do this it would require the services of a properly equipped party of surveyors, and it would take several months to secure the information and data that would be necessary to prepare such a report. Therefore, I respectfully request your consideration of the following statements and suggestions before making the requisition for the equipment and assistance necessary to accomplish your instructions.

After reading with care the various reports of the United States Geological Survey relating to the investigation of the question of the storage of water along the Gila River—ostensibly for the benefit of the Pima Indians—and referred to me in connection with your letter of instructions, I am chiefly impressed with the theoretical and speculative character of the results of these investigations, and it is difficult to believe that Congress could be induced to appropriate the very large sum of money (directly and incidentally involved, several millions of dollars) required to construct the proposed reservoir and appurtenances upon the showing made in these reports and the tentative conclusions derived from these investigations, especially in view of the fact that such an undertaking would inaugurate a policy of Government patronage hitherto eschewed.

There is so much uncertainty and improbability involved in this reservoir proposition that it is difficult, if not impossible, to attempt to plan or even consider from a practical standpoint any system of irrigation for the Pima Indian Reservation at this time based upon the possibility of its consummation. All of the proposed reservoirs are remote from the reservation (the nearest over 30 miles and the farthest nearly 200 miles distant), and the intervening country is so mountainous and broken that it would be impracticable, except at enormous cost, to convey the water from any of them to the reservation through a ditch; therefore it must be expected that the water should reach the reservation through the natural channel of the river, in which case any system of ditches planned for irrigating the reservation should be devised just as though no reservoir existed, to be supplied with whatever water that might escape from appropriators above and from evaporation and seepage en route.

The Gila River is subject to such violent and prodigious fluctuations that the chief difficulty as well as the principal expense of taking water from it through a ditch is to construct suitable diverting works, such as can withstand the floods and at the same time secure all of the low-water flow. The plan usually adopted is to rebuild the upper portion of the ditch after each flood, although in the end this is always the most expensive method.

If the head or the beginning of the ditch is located at a point where outcropping rock confines the river to a permanent channel of moderate width, it is possible to construct within reasonable cost diverting works with controlling gates that would give some assurance of security and permanency, but such favorable locations are seldom found suitable to other essential conditions.

There are to be found along the Gila River several expensive ditches, costing hundreds of thousands of dollars (one upon which a million has been expended), that are practically abandoned, largely on account of the impossibility of maintaining the head works from destruction.

Thirty thousand dollars is too small an amount with which to undertake the construction of a ditch taking water from the Gila River under ordinary conditions and according to the usual methods, and it is too large an amount to waste in attempting to do what others have failed to do with much larger amounts.

There is no other region of country that I am familiar with where the natural elements are so destructive and difficult to contend with as here. This is especially true in regard to wind and rain. In other regions nature often affords some sort of protection with mantle of vegetation, but here vegetation has all it can do to take care of itself, and in so doing contributes to the general destruction. In Montana I have known a plow furrow to be sodded over with grass in a few weeks and to remain intact for years. Here a plow furrow would be obliterated entirely in a few weeks. The heat is intense and withering, the winds violent and prevailing, and the rain, when it does rain, falls in a deluge, and, owing to the slight declivity of the country, has a tendency to spread out and fill up and level down everything, rather than to erode and washout. A ditch seems to be an especial object of assault and destruction.

In support of these statements there are to be found all over this region, and particularly in the Gila Valley, evidences of a former occupation of the country by a large number of people who engaged, unquestionably, in agriculture by irrigation on an extensive scale, but so completely have their works of various kinds been destroyed and obliterated that remaining vestiges fail to convey any idea of their character, and only serve to excite the imagination. That there were formerly here extensive systems of irrigation ditches there can be no possible doubt, but where they began or terminated, or in what manner they were utilized, there remains nothing to reveal. At numerous places there are unmistakable evidences of artificial water channels, presumably irrigation ditches, that must have been built in the most substantial manner (some with rock-laid walls), and which in any other country would have remained sufficiently preserved to have indicated the purpose of their construction for thousands of years, but so completely have they been effaced by the destructive elements of this region that they can now only be discovered by careful search.

I refer to these facts to indicate how useless it would be to construct any system of ditches that could not be put to immediate use, and that would not be maintained and preserved by the vigilance and effort of those depending upon such ditches for their support.

That portion of the Gila Valley embraced within the reservation has the appearance of a shallow trough-like basin, the river channel (generally a mile or so in width) occupying the central portion of it, and depressed but slightly below the floor of the valley. The fall, which is to the west, probably does not exceed 6 or 7 feet to the mile, but laterally, toward the river, it is considerably more than this, the slopes extending from the foot of a succession of segregated groups of low mountains and isolated buttes, lying 5 or 6 miles back from the river; and the drainage from the mountains to the river is nearly at right angles with its course. There are no well-defined drainage channels and but few depressions, and the flood water flows to the river

very much as the rainwater flows down the roof of a house. Any ditch built to irrigate the lands of the reservation must necessarily traverse the sloping sides of the valley, and will, in consequence, intercept all of the flood water, which would speedily destroy it, unless protected in some way by artificial drainage channels conducting the flood water to suitable crossings.

These conditions complicate very much the question of a proper location and plan for any system of ditches calculated to supply the Pima Indians with water for irrigation, and the cost of such a system will be very materially increased by reason of such conditions if it should be successfully constructed. It must be apparent that it is no trivial undertaking to devise a proper plan and prepare specifications and estimates of cost for any system of ditches for this reservation that would be of any value whatever, and it would be a serious mistake to repeat the failures heretofore made in this same direction.

Some ten or twelve years ago Agent Crouse was permitted to expend a considerable sum of money in the experiment of constructing an irrigating ditch on this reservation, which was a failure from the beginning, and there remains scarcely enough of it to recognize now as a ditch. It was taken from the south bank of the river at a point about 3 miles above the east line of the reservation, and extended down the south side of the river about 12 miles to a point within 6 or 8 miles of the agency.

It appears to have been located with considerable care, and to have been fairly well constructed, considering the size of it. It covered a fine body of land, and had it been possible to protect it against the ravages of the river floods it would have been of great assistance to the Indians; but they never succeeded in getting the water into it below the first few miles, and it was finally abandoned. It cost, as I am informed, about \$8,000, and was manifestly a useless expenditure of money.

The difficulty with this ditch was—and it would be the same with any ditch that might be built now on the same plan—that when there was water enough in the river—during the floods—to fill it, there was enough to destroy it, and it was washed out and rendered useless, and when the flood subsided there was no water left in the river to supply it, and, of course, it was useless.

#### DEVELOPMENT OF THE UNDERFLOW.

There is, in my judgment, a more feasible plan for assisting these Indians than by constructing a system of ditches, that must remain idle and useless for an indefinite period, perhaps forever, and one that will, without any question, enable them to secure a very considerable supply of water for irrigating their land, and may eventually afford them all the water that will be necessary to irrigate the lands required for their support, and that is to develop and bring to the surface the underground waters.

That there is an inexhaustible supply of water underlying the valley of the Gila there can be no possible doubt, for it has been disclosed in scores of instances and places on the reservation as well as outside of it, both above and below, and it is to be found not only underneath the bed of the river and in the vicinity of it, but for some distance away from it, on both sides. It is found at various depths, in some

places quite at the surface, and at others some distance below it, allowing for relative difference for elevation, which indicate that it is forced up at places, and follows the undulations of an impervious underlying stratum of rock or hardpan. It is evidently not in a static condition, therefore it is in reality an "underflow," for wherever encountered it is nearly always observed to be flowing either toward the river or in the same direction as the river.

It comes to the surface at frequent intervals in the bed of the river channel and near-by places, in the shape of swamps, pools, ponds, springs, and in some instances running streams. Of course it is not a sheet of flowing water overlaid by a stratum of surface soil, but a saturated subsoil of sand and gravel, porous enough to permit the water to percolate freely through, and overlying an impervious formation of rock or other material, and which, although irregular of surface, has the same general slope and fall as the country, permitting the water to flow down the valley underground; and where it is forced to the upper surface or near it there must exist a reef or a ridge or a bulge in the lower formation.

At a number of places on the reservation the Indians have, in a crude way, dug into this water-bearing stratum and tapped it, by drawing the water into the open ditches, which, following the slope of the valley with less fall, convey the water to the surface, whence it is conducted to their farms for irrigation.

Although their methods for developing this supply of water from the "underflow" are crude, and the results not very satisfactory in view of the vast amount of labor involved for the small amount of water obtained, yet the Indians have in a practical manner demonstrated the feasibility of the plan that I am suggesting, and it seems to me possible, by resorting to proper methods and by the use of suitable machinery, to develop in the manner indicated all of the water that will be necessary to irrigate the lands of the Pima Indians, particularly those that were formerly under cultivation and which they manage to secure a comfortable living from.

There are probably 1,500 of these people that are largely supported from the farms that are irrigated from the "underflow" at this time, and at a number of places they are now working on ditches with this same object in view, although with no very great enthusiasm, for they well know the amount of labor required, and the liability of the results, of their labor being destroyed at any time.

The principal difficulty that they have to contend with in the construction of these ditches arises from their inability to excavate to any depth into the water-bearing sand with such implements as they have—shovels and hoes. A man can not excavate in or under water beyond a depth of 2 or 3 feet by hand labor with any degree of success, although the Indians have excavated one or two of their ditches deeper than this.

The oozing quicksand and loose material that is constantly working back into the channel prevents them from getting more than a small proportion of the water that is available.

A ditch for such a purpose would in most cases have to be of unusual depth to reach and penetrate the "underflow," and in addition to the difficulty of excavating such a ditch by hand it is almost an impossibility to preserve it in any sort of serviceable state for any length of time, as it is so easily rendered useless and destroyed.



To accomplish such a work successfully the channel should first be excavated by machinery—a steam shovel or dredge—and it should be excavated well into the water-bearing stratum, allowing the water in the ditch to be from 8 to 10 feet deep, and then a continuous wooden pipe or box of proper size, and loosely jointed to permit the water to enter freely, should be placed in the channel, and, if practicable, covered first with broken rock and then back filled and buried. Being always submerged in water the wooden pipe would last for many years, indefinitely, and being buried it would be out of reach of the floods and free from disturbance or injury. This pipe should extend far enough down the valley to deliver the water at the surface sufficiently above the river to be out of the reach of the flood water. When delivered at such a place the Indians would gladly take care of the water, building and maintaining their own ditches and relieving the Government of any further responsibility whatever in regard to the matter. This they are abundantly capable of doing, as they have constructed and operated such ditches as would be necessary to convey and distribute the amount of water that these pipes would yield for generations.

A series of these pipes might be laid conveying the water alternately to each side of the river, suited in the most advantageous manner to the best areas of irrigable lands.

In addition to the underground water basin of the Gila River there are several drainage basins of considerable importance that are tributary to the reservation that might be drawn from for a further supply if it should be necessary. At the upper end of the reservation there is a drainage basin (it is a shallow depression a mile or so in width, with no well-defined wash or flood-water channel) coming in from the southeast that drains quite a large section of country and is known to be well supplied with subsurface water. There are a number of wells scattered along this basin, showing that the water exists there within a few feet of the surface and stands at an elevation of 60 feet or more above an area of fine farming land on the reservation that might be supplied from such a source. Toward the western end of the reservation the Santa Cruz River comes in from the south. This stream has no well-defined channel, but is a broad, shallow, basin-like depression similar to that described above and, except at flood time, a dry sand bed; but it is known to carry a large volume of underflow, which could be made to carry a large supply of irrigating water for the lands of the reservation. There are several other places along the north side of the river where these same conditions exist.

From a careful study of the subterranean water sources of the Pima Reservation I am firmly convinced that by this development process enough water can be secured to supply all of the lands that may be required to support this entire tribe of Indians.

There are many advantages attaching to this plan of developing a water supply for these Indians, if it can be successfully accomplished, that it is not necessary to mention herein, as they will be apparent upon reflection, the value of which it will be difficult to estimate.

The undertaking could be entered upon at no great expense, and if shown to be successful it could be carried out on a more extensive scale subsequently.

The principal item of expense in the beginning would be the cost of the necessary machinery—a dredge and a pile driver. The pile driver might be dispensed with until the project has been proven to be a suc-

cess or failure in the first trial case and employed later on the larger pipes if the first, a small one, should operate satisfactorily.

The cost of a suitable dredge set up in place and ready for working would be in the neighborhood of \$8,000, as may be seen from the letter and catalogue of the Marion Steam Shovel Company submitted herewith (marked "A").

To operate this dredge there will be required three skilled mechanics, the cranesman, the engineer, and an assistant engineer. The wages of these men would range from \$65 to \$90 per month. There would be required several assistant laborers, and Indians might be employed for this sort of work. The cost of dredging would probably run from \$20 to \$25 per day. Outside of this expense the main item of cost would be that of lumber for making the pipe or box, and this could be laid mostly with Indian labor, only one or two skilled white men being necessary.

I have employed these dredges in the construction of irrigation ditches in several instances, and personally know that the work done by them is exceedingly satisfactory in deep excavating or in water-soaked material, and I know of no other way of accomplishing such excavation as is proposed in the plan suggested herein.

The idea embodied in this suggestion is similar to that employed in underdraining a farm, only on a larger scale, which is to underdrain a section of river and contiguous territory and deliver the water at a point where the Indians can convey it to their lands through a system of ditches of their own construction, and for which they will be responsible for maintaining and operating; and when these water-collecting pipes are once in place they are not likely to be destroyed or disturbed by floods or anything else, and will need little, if any, attention or care for an indefinite time thereafter.

On account of the exhaustion of the water in the Gila River and a drought of unusual duration, lasting now several years, these Indians, or many of them, are in a state of great destitution and want, and although the agent has resorted to every possible means of assisting them and has done everything in his power to provide for them, they are still in great distress and need assistance. The plan that I am suggesting for the development of their water resources offers no immediate relief, and is not submitted with that idea in view, for it will take considerable time to make the necessary preparations to undertake such a work as I propose, and should be considered outside of any measures that are incumbent upon the Department at this time for their relief.

While at the agency and on the reservation I had an opportunity to observe the manner in which aid is extended to the Indians, and I think it is altogether wrong. It is the custom to issue indiscriminately to them portions of wheat—the amount depending upon the appearance of the applicant; the more pitiable the appearance, the larger the portion—and the larger proportion of this wheat is taken immediately to the traders' stores and exchanged for other commodities, such as coffee, sugar, clothing, etc. Of course the trader exchanges at a profit, both in the purchase and the sale, and the Indian receives less than he would if he were issued cash and allowed to purchase directly what he wants.

There is no census or schedule of the Indians belonging to the reser-

vation, and consequently no means of knowing who the applicants are or whether they are proper subjects for assistance or not. Notwithstanding the conscientious efforts of the agent (for I believe he is entirely honest in the matter), there is no doubt that his discriminations are often unfair and that he is often imposed upon.

The results are not at all satisfactory, and considerable discontent has arisen among the Indians on account of the issues that are being made. Not knowing the plans or desires of the Department in regard to this matter, I am at a loss to make any suggestions in regard to it, but I do know that the methods that are now in vogue are productive of much discontent and place the agent in a position to be criticized and suspected, and some other means of relieving distress of these people should be adopted.

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I am, very respectfully,

WALTER H. GRAVES,  
*United States Indian Inspector.*

The SECRETARY OF THE INTERIOR,  
*Washington, D. C.*

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